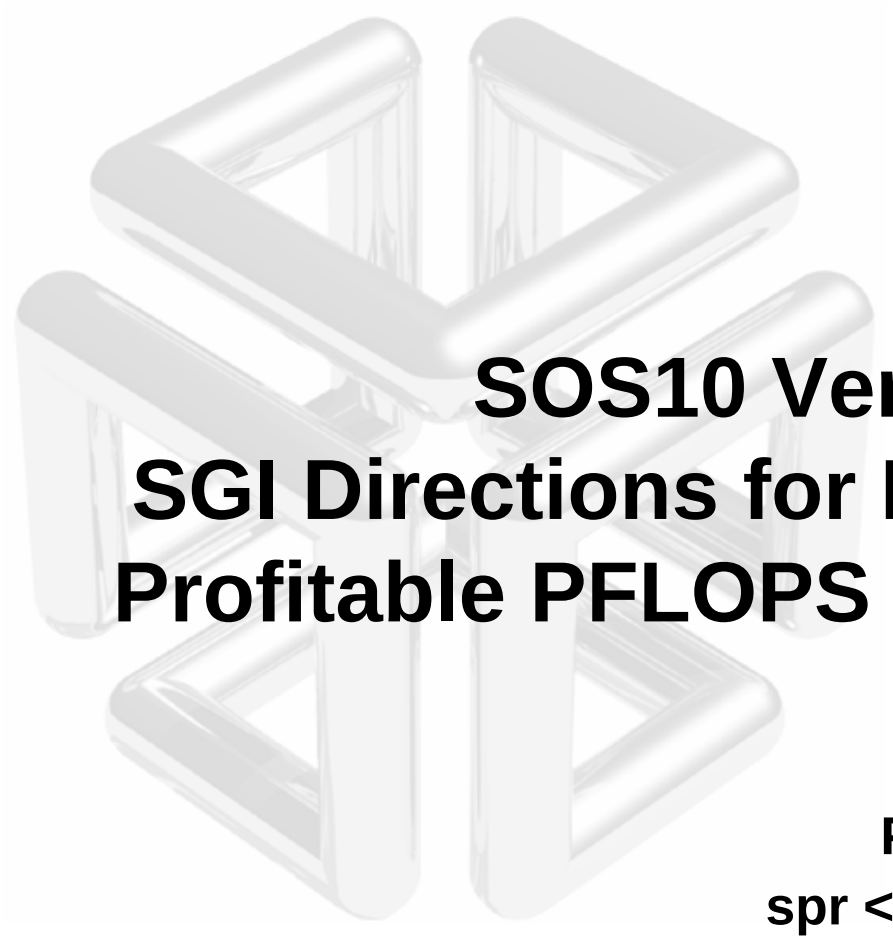

SOS10 Vendor Panel: SGI Directions for Productive, Profitable PFLOPS Computing

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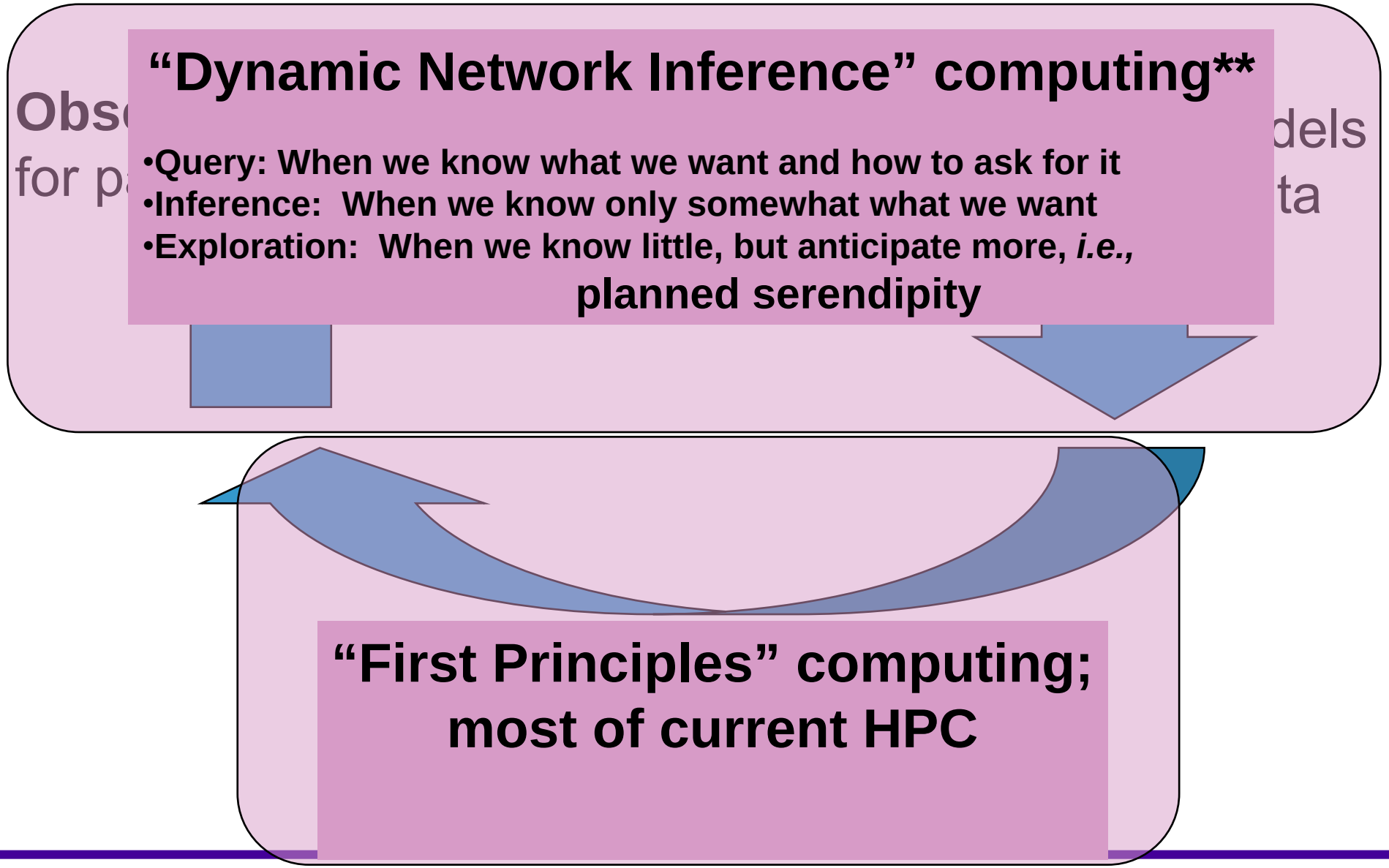
SGI is shifting the focus of its system architecture, to accelerating the discovery of knowledge in immense data.

Scientific Process



**Who coined this???

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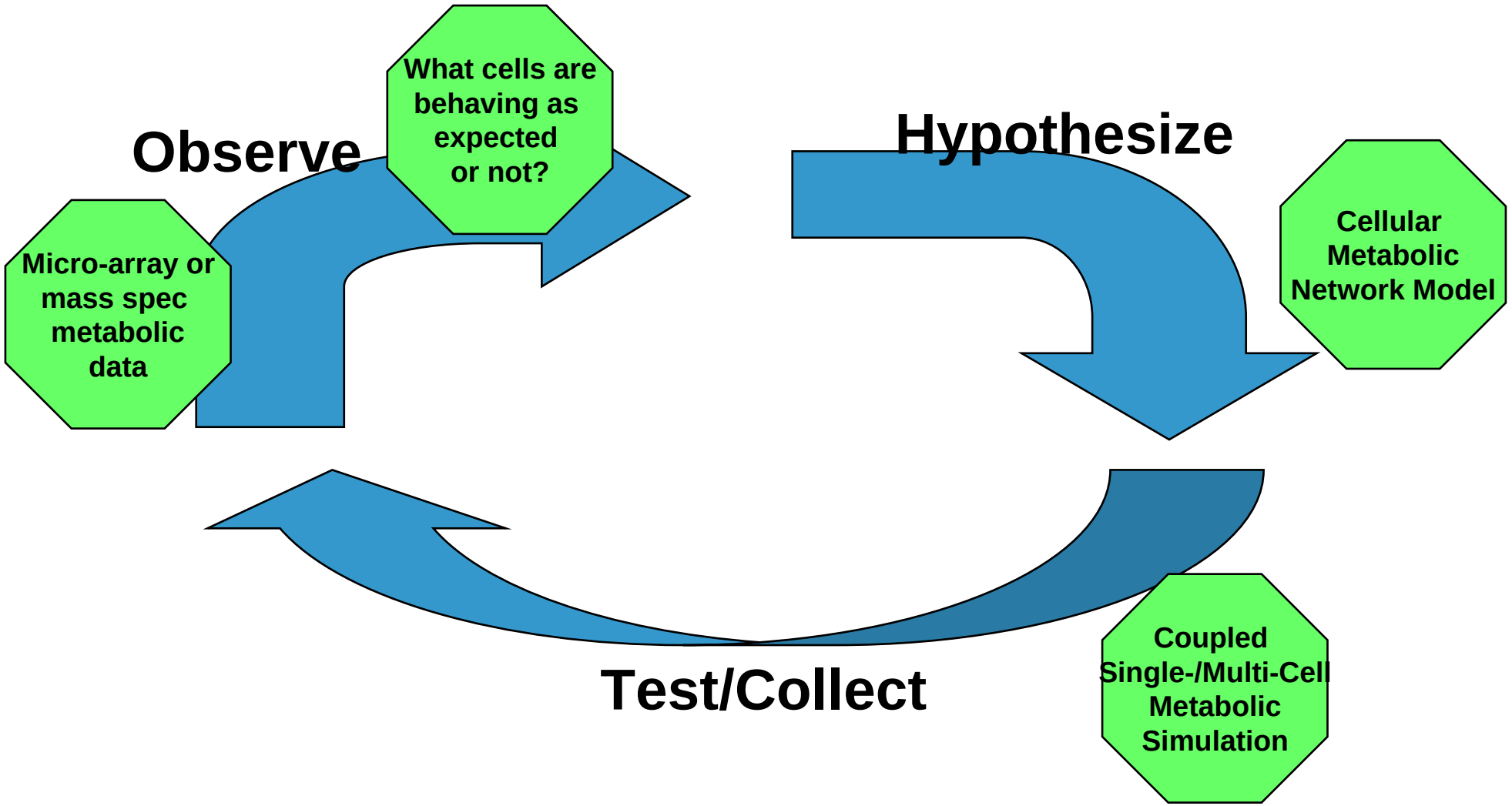
Pattern Discovery in Biology**:
Metabolic Behavior of Communities of Cells



**Other examples from climate change research

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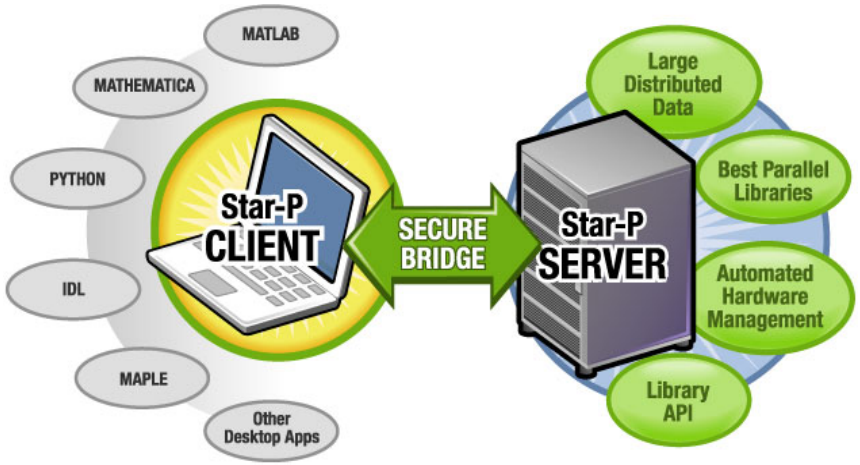
System Requirements for Knowledge Discovery

1. Major commodity content for feasibility/affordability
2. **Big memory** (PB by 2009)
3. Big data ingest/storage (150+Gb/s/link, 80GB/s to a single FS, 100PB FS)
4. Heterogeneous processing
   - FPGAs, special-purpose processors (*e.g.*, ClearSpeed, Cell)
5. RAS for production-worthiness
6. **Rapid application development**
   - Star-P, Graph Analysis and Pattern Discovery toolbox
7. In-the-loop visualization of big data (1TB)

Big Memory

- Need to consider the whole graph at once ->PB
- Graphs typically don't exhibit locality -> GAM, global strided/random, large-span TLBs
- Graph algorithms don't use simple synchronization -> irregular, data-driven synch among dynamic groups of processors
- Info is crucially valuable -> RAS

Rapid Application Development




```
a = rand(n,n*p);
ppload imagedata a
[nrow ncol] = size(a);
b = ones(nrow,ncol);
c = fft2(a);
d = ifft2(c);

diff = max(max(abs(a-d)));
if (diff > 10*eps)
   sprintf('Error, diff=%f',
 diff);
end
```

- Star-P
  - extends MATLAB language for ||ism
  - very high (>95%) reuse of existing MATLAB code
  - retains interactivity
  - addresses new audience of users
  - builds on parallel libraries
  - demonstrated 2.8TB array
  - causes MPI usage to plummet
- Pattern Discovery
  - **cSSCA#2:**
    - **110 SLOC total, 5X fewer than MATLABmpi, 9X fewer than C/pthreads**
    - **strong scaling to 10^9 edges/128P**
  - **Graph Analysis Toolbox**
  - **Pattern Discovery Toolbox**
  - **first use of PB system**

Answers to Moderator Questions

- What will be SGI's PFLOPS architecture?
  - Ultraviolet: GAM, efficient access, extreme synch, hetero processing
  - mass market content: processors, memory, network physical layer, OS
- How will we increase apps scalability?
  - petascale: efficient memory access, extreme synchronization
  - serial MATLAB: → parallel Star-P
- Size of HPC market? How can HPC customers help?
  - Much bigger if artificial barriers (*e.g.,* MPI/Fortran/C required) removed
  - Make large purchases an honest business
- Closest competitors?
  - Overall: today's, with cluster vendors becoming more prominent
  - Knowledge discovery: ???
- What will be SGI's HPC successes in 2009?
  - Establishment of bona fide knowledge discovery market
  - Connection with much larger market of users via Star-P

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Agenda

- Relevance of pattern discovery outside national security
- System requirements for pattern discovery
- Answers to moderator questions